REMARKS

Summary of Examiner Interview

Applicant thanks Examiner David J. Goodwin for the telephonic interview conducted on April 16th, 2009. Applicant was represented by Mr. Rex Huang and Mr. Indranil Sarkar.

The claims and the Smith reference (Attenuated phase shift mask materials for 248 and 193 nm lithography, J. Vac. Sci. Technol. B, vol. 14, no. 6, pp 3719-3722) were discussed. An agreement was reached that the Smith reference does not disclose a silicon-rich silicon nitride layer of the form "SiNx:H with x in the range 0 to 1." The Examiner agreed not to make the next action from the Office a final rejection.

35 U.S.C. § 103

In the Office action dated December 24, 2008, the Examiner rejected claims 1-3 and 9-11 under 35 U.S.C. 103(a) as being unpatentable over Nakao (US 5,882,827) in view of Smith (Attenuated phase shift mask materials for 248 and 193 nm lithography, J. Vac. Sci. Technol. B, vol. 14, no. 6, pp 3719-3722).

Claim 1

The Examiner states:

> **4. Nakao teaches a mask comprising a mask substrate (1) a half tone mask material (3) arranged in a pattern across the mask substrate (1) and a light-blocking layer (5) arranged in a pattern across the half tone layer (3).**
>
> **5. Nakao does not teach that the half tone layer comprises silicon nitride.**
>
> **6. Smith teaches the composition of a half tone mask, in a range of amorphous silicon to stoichiometric silicon nitride, i.e., said composition being a silicon rich silicon nitride, SiN(X) where 0<=X<=1.**
>
> **7. It would have been obvious to one of ordinary skill in the art to use silicon nitride in order to change the phase of the incident light.**
>
> **8. Nakao in view of Smith does not teach the thickness or transmissivity of the silicon nitride.**
>
> **9. It would have been obvious to one of ordinary skill in the art to form a mask layer having a transmissivity of 20% and a thickness in order to change the phase of the incident light (page 3722, section C) (fig 5).**

Applicant disagrees and submits that Nakao and Smith, alone or in combination, do not disclose or suggest all the features of independent claim 1.

The Examiner acknowledges that Nakao does not disclose a half tone layer to comprise silicon nitride and relies on Smith to allegedly teach this feature. Applicant submits that Smith also fails to disclose or suggest "…the half-tone mask material is silicon-rich silicon nitride SiNx:H with x in the range 0 to 1… ." Rather, Smith describes nonstoichiometric silicon nitride that is substantially different from that of the silicon rich silicon nitride as recited in claim 1. For example, Smith describes a film of Si_3N_4 which is not of the form SiN_x:H with x in the range 0 to 1. There is no hydrogen (H) present in the silicon nitride layer of Smith. The reactants chosen by Smith are Si and nitrodren/argon gas mixtures (see Smith p. 3722, section C, lines 1-2), in which the reactants do not include hydrogen. In contrast, the silicon rich silicon nitride is of the form SiN_x:H with x in the range 0 to 1 and manufactured using plasma deposition where amounts of ammonia (NH_3) and silane (SiH_4) are controlled to vary the optical band gap of the silicon nitride layer[1]. Therefore, Smith fails to disclose or suggest "…the half-tone mask material is silicon-rich silicon nitride SiNx:H with x in the range 0 to 1… .", as recited in independent claim 1.

Further, the optical properties of the non stoichiometric silicon nitride of Smith is substantially different from the properties of the silicon rich silicon nitride as recited by independent claim 1. For example, Smith describes the film of Si_3N_4 to have a transmission of "nearly 20%." Smith further describes that when additional silicon is introduced into the silicon nitride film of Smith, the transmission is *reduced*. As described by Smith[2]:

> The optical properties of stoichiometric Si_3N_4 are 2.68 and 0.27 for n and k, respectively, at 193 nm. Transmission is near 20% for 574 Å producing a 180° phase shift while reflectance is 21%. By introducing additional silicon into a film, n and k can be modified to reduce transmission and reflectance.

Therefore, even if the non stoichiometric silicon nitride of Smith was construed, *arguendo*, to be equivalent to the silicon rich silicon nitride of the form SiN_x:H with x in the range 0 to 1, Smith would still not disclose or suggest providing "… a transmittance in the range

[1] Applicant's Specification, Page 2, line 30 – Page 3, line 1.
[2] Smith, Page 3722, Section C

of 20% to 80%." On the contrary, such a modification would reduce the transmission rate from the "near 20%" achieved by Smith using Si_3N_4.

Applicant submits that Nakao and Smith, alone or in combination fails to disclose or teach each and every feature of amended independent claim 1 at least for the foregoing reasons and claim 1 is therefore patentable over Nakao and Smith.

All of the dependent claims are patentable for at least the reasons for which the claims on which they depend are patentable.

Canceled claims have been canceled without prejudice or disclaimer.

Any circumstance in which the applicant has addressed certain comments of the examiner does not mean that the applicant concedes other comments of the examiner. Any circumstance in which the applicant has made arguments for the patentability of some claims does not mean that there are not other good reasons for patentability of those claims and other claims. Any circumstance in which the applicant has amended or canceled a claim does not mean that the applicant concedes any of the examiner's positions with respect to that claim or other claims.

Please apply $104 for the excess claim fees and $130 for the Petition for Extension of Time fee and any other charges or credits to deposit account 06-1050.

Respectfully submitted,

Date: April 21, 2009_____

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